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Twist-beam axle for the rear suspension of a motor vehicle and method for its production

The present invention relates to a twist-beam axle for the rear suspension of a motor vehicle, as well as a method for the production of such a twist-beam axle.

It is known in the automotive field the use of rear suspensions in which the two rear wheels are interconnected by means of a twist-beam axle comprising basically a central cross-member compliant to torsion, which extends substantially transversely, and a pair of rigid trailing arms, attached to the ends of the cross-member, which support the rear wheels and provide the articulation of the axle to the vehicle body.

According to the prior art, the trailing arms of the twist-beam axle are formed as elongated integral bodies, for example of tubular shape, which are securely connected to the cross-member, for example by welding. Alternatively, a pair of trailing half-arms, that is, a front half-arm and a rear half-arm, respectively, may be provided for instead of a single trailing arm, wherein usually the rear half-arm is formed as a single piece with the cross-member whereas the front one is fixed to the cross-member, for example by welding. These known arrangements, which require a welded joint to be provided between the trailing arms, or the half-arms, and the cross-member, require a high dimensional and shape precision in the welding zones, in order to ensure the correct relative positioning of the parts to be connected and the strength of the welded connection.

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A twist-beam axle according to the preamble of Claim 1 is known from EP-A-0 743 205. According to this known solution, each trailing arm comprises a pair of transversely inner half-shells, that is, a front half-shell and a rear half-shell, respectively, which are formed by prolongations of the respective end portion of the cross member, and a transversely outer half-shell securely connected to the pair of transversely inner half-shells so as to form therewith a structure having a closed cross-section.

It is the object of the present invention to provide an improved twist-beam axle for the rear suspension of a motor vehicle with respect to the prior art, which is strong and easy to manufacture and which enables the taking-up of possible plays in the zones of connection between the trailing arms and the cross-member.

This object is fully achieved according to the invention by virtue of a twist-beam axle for the rear suspension of a motor vehicle having the characteristics defined in independent Claim 1. According to another aspect of the invention, this object is fully achieved by virtue of a method for the production of a twist-beam axle for the rear suspension of a motor vehicle as defined in independent Claim 9.

In short, the invention is based on the idea of providing a twist-beam axle in which each of the two trailing arms is comprised of a pair of first, transversely inner half-shells, that is, a front half-shell and a rear half-shell, respectively, securely connected to each other and to the respective end of the cross-member by welding, and of a second, transversely outer half-shell, securely connected to the first two half-shells by welding so as to form therewith a rigid body having a closed cross-section.

The characteristics and the advantages of the invention will appear from the detailed description which follows, given purely by way of non-limiting example with reference to the appended drawings, in which:

Figures 1 and 2 are perspective views from above and from below, respectively, of a side end portion of a twist-beam axle

according to the invention;

Figure 3 is an exploded perspective view of the portion of twist-beam axle shown in Figures 1 and 2;

Figure 4 is a plan view from above of the portion of twist-beam axle shown in the preceding figures;

Figure 5 is a section view along line V-V in Figure 4 of the portion of twist-beam axle shown in the preceding figures;

Figure 6 is a section view along line VI-VI in Figure 4 of the portion of twist-beam axle shown in Figures 1 to 4;

Figure 7 is a section view along line VII-VII in Figure 4 of the portion of twist-beam axle shown in Figures 1 to 4;

Figure 8 is a section view along line VIII-VIII in Figure 4 of the portion of twist-beam axle shown in Figures 1 to 4; and

Figure 9 is a section view along line IX-IX in Figure 4 of the portion of twist-beam axle shown in Figures 1 to 4.

In the description and the claims which follow, terms such as "longitudinal" and "transverse", "inner" and "outer", "front" and "rear" are to be understood as referred to the mounted condition on the vehicle.

Although only one of the two symmetric parts forming the structure of the twist-beam axle in question has been described and illustrated, for clear reasons of simplicity, it

is clearly understood that the non-described part is to be considered symmetric, or substantially symmetric, to that described.

By referring initially to Figures 1 to 4, a twist-beam axle for the rear suspension of a motor vehicle is generally indicated 10 and comprises a central cross-member 11 and a pair of trailing arms 12 fixed to respective side end portions 11a of the cross-member (in the figures only the left-hand end is shown). A bush 13 for articulation of the twist-beam axle 10 to the vehicle body is fixed to the front end of each trailing arm 12, whereas on a mounting structure 14 for a wheel-carrier (not shown) and a sheet plate 15 intended to provide a lower support surface for a spring (also, not shown) are fixed to the rear portion of the arm 12, on the transversely outer side and the transversely inner side, respectively.

The middle portion of the cross-member 11, indicated 11b, has in its vertical plane of symmetry a cross-section of predetermined shape, in the illustrated example an omega-shape, adapted to provide the cross-member with the required elastic characteristics, in particular the compliance to torsion. The end portions 11a of the cross-member 11 form each a head wall 11c, downwardly inclined in the transverse direction, in which a hole 16 is provided for being passed through by a torsion bar 17 housed inside the middle portion 11b of the cross-member 11 and fixed at its ends to the trailing arms 12. Alternatively, the torsion bar 17 may be fixed to the head walls 11c of the side portions 11a of the cross-member, instead of being fixed to the trailing arms 12. Moreover, the middle portion 11b of the cross-member may assume obviously any other suitable shape, either open (as in the illus-

trated example) or closed.

According to the invention, each trailing arm 12 is comprised of three sheet metal parts 18, 19 and 20, formed as half-shells with open, essentially C-shaped cross-section, securely connected to each other, preferably by welding. These elements are a pair of transversely inner half-shells 18 and 19, that is, a front half-shell and a rear half-shell, respectively, intended to be fixed to the end portion 11a of the cross-member 11, and a transversely outer half-shell 20, intended to be fixed to the two inner half-shells 18, 19 so as to close the cross-section of the arm 12.

Each of the two inner half-shells 18, 19 comprises a first limb 18a, 19a which extends essentially transversely and a second limb 18b, 19b, integral with the first one, which extends essentially longitudinally or is slightly inclined outwards relative to the longitudinal direction (Figure 3).

Each first limb 18a, 19a is arranged to be welded both to the respective end portion 11a of the cross-member, along a transversely inner edge 21 suitably shaped to fit to the cross-member portion 11a, and to the other first limb 19a, 18a, along a pair of transverse straight edges 22, 23 that is, an upper edge and a lower edge, respectively, arranged in use facing each other. Each second limb 18b, 19b is arranged to be welded to the outer half-shell 20 along a pair of transversely outer edges 24, 25 that is, an upper edge and a lower edge, respectively.

In order to enable to take up possible plays between the two inner half-shells 18, 19 and the cross-member portion 11a,

the two half-shells are shaped and dimensioned in such a manner that, when they are arranged in their mounting position on to the cross-member, their facing edges 22, 23 are spaced apart by a certain gap, though very little, which is then filled by the welding bead which joins the two half-shells together along the edges 22, 23 during the assembling of the axle.

Each transversely outer half-shell 20 has a substantially C-shaped cross-section, the upper and lower horizontal walls of which form transversely inner edges 26 and 27, that is, an upper edge and a lower edge, respectively, for connection by welding to the transversely outer edges of the longitudinal limbs of the half-shells 18, 19. Where the torsion bar 17 is fixed to the trailing arms 12, as in the illustrated embodiment, the vertical walls of the outer half-shells 20 have respective holes 28 for engaging the ends of the bar 17.

As can be seen in the exploded view of Figure 3 and in the section view of Figure 6, each rear inner half-shell 19 and each outer half-shell 20 have respective through holes 29 and 30 into which a pin 31 is inserted for fixing the lower end of a damper (not shown).

As will be clear in the light of the preceding description, the method of production of a twist-beam axle according to the invention provides for, first of all, the manufacturing of the single parts of the axle, that is to say, the cross-member 11, the torsion bar 17 and the half-shells 18 to 20 intended to compose the trailing arms 12, and then the assembling of these parts by welding the pairs of inner half-shells 18, 19 onto the cross-member 11 and the outer half-

shells 20 onto the pairs of inner half-shells of the respective trailing arms.

Since the joining edges 21 to 27 of the half-shells 18 to 20 extend essentially in two dimensions, instead of three dimensions, the welding operations are easy to perform.

Naturally, the principle of the invention remaining unchanged, embodiments and manufacturing details may vary widely from those described and illustrated purely by way of non-limiting example.